

III. SKELETAL SYSTEM

BONY THORAX

24

See 22

CN: Use the same colors as were used on Plate 22 for true ribs, thoracic vertebrae, demifacets, and transverse process facets. Use bright colors for A-C. (1) Color the anterior view of the bony thorax. Color each rib completely before going on to the next. (2) Color the posterior

view in the same manner. (3) Color the lateral view of the bony thorax. (4) When coloring the drawings of a rib and the sites of articulation, note that the rib facets (drawn with dotted lines) are to be colored even though they are on the underside of the rib.

STERNUM:*

MANUBRIUM^A

BODY^B

XIPHOID PROCESS^C

12 RIBS:*

7 TRUE^D

5 FALSE^E

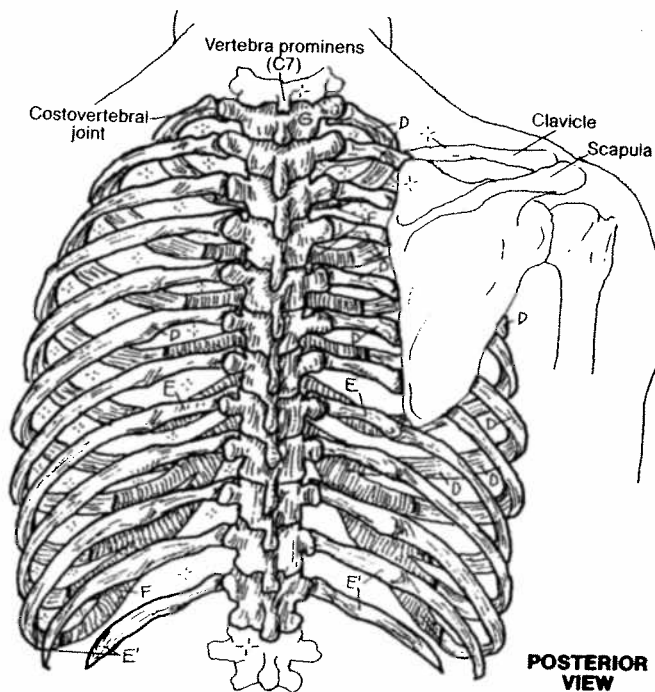
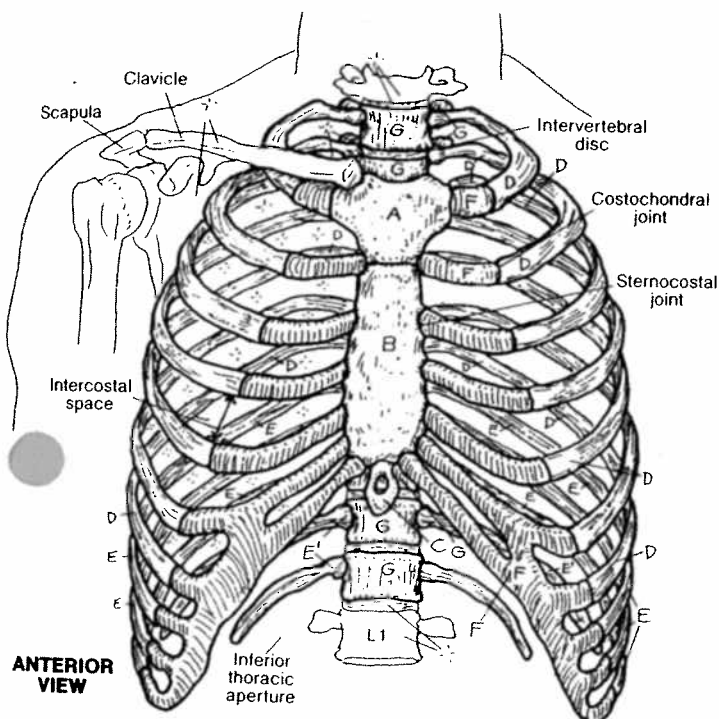
(2 FLOATING)^{E'}

COSTAL

CARTILAGE (10)^F

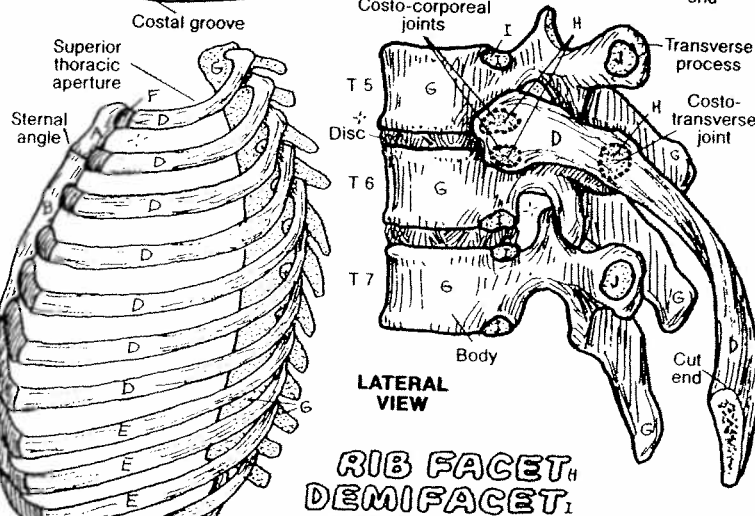
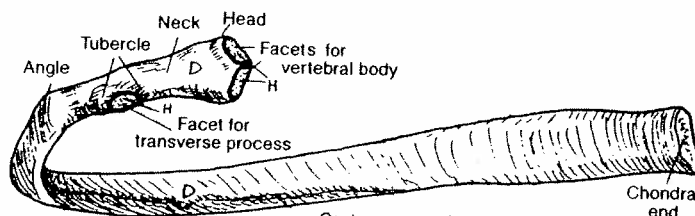
THORACIC

VERTEBRA (12)^G



The bony thorax is the skeleton of the chest, representing a fairly mobile set of structures important to respiration and harboring the heart, lungs, and other significant organs. The superior thoracic aperture (thoracic inlet; often incorrectly termed thoracic outlet in a clinical context) transmits the esophagus, trachea, nerves, and important ducts and vessels. The inferior thoracic aperture is virtually sealed by the thoracic diaphragm. The space between ribs is the intercostal space, and contains three layers of muscle and fascia, and intercostal vessels and nerves. Collective rib movement is responsible for about 25% of the respiratory effort.

The fibrocartilaginous joint between the manubrium and the body of the sternum (sternal angle, sternomanubrial joint) makes subtle hinge-like movements during respiration. The xiphoid makes a fibrocartilaginous (xiphisternal) joint with the body of the sternum. The sternum is largely cancellous bone containing red marrow. The costal cartilages, representing unossified cartilage models of the anterior ribs, articulate with the sternum by gliding-type synovial joints (sternocostal joints; except for the first joint, which is not synovial). All ribs form synovial joints with the thoracic vertebrae (costovertebral joints). Within each of these joints, the rib (2 through 9) forms a synovial joint with a demifacet of the upper vertebral body and with a demifacet of the lower body (costocorporeal joints). In addition, the tubercle of the rib articulates with a cartilaginous facet at the tip of the transverse process of the lower vertebra (costotransverse joint). Ribs 1, 10, 11, 12 each join with one vertebra instead of two; ribs 11 and 12 have no costotransverse joints. True ribs (1-7) articulate directly with the sternum; false ribs (8-12) articulate indirectly with the sternum (via cartilages connecting to the 7th costal cartilage); floating ribs (11, 12) and the

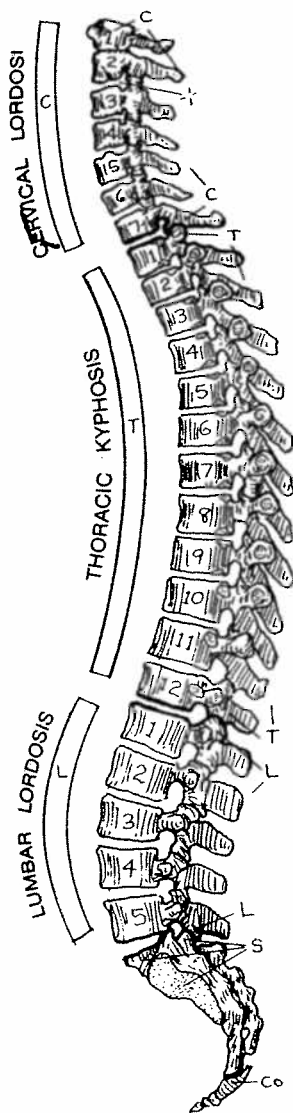


RIB FACET^H
DEMIFACET^I

III. SKELETAL SYSTEM

VERTEBRAL COLUMN

REGIONS:*
CERVICAL^c
THORACIC^t
LUMBAR^l
SACRAL^s
COCCYGEAL^{co}



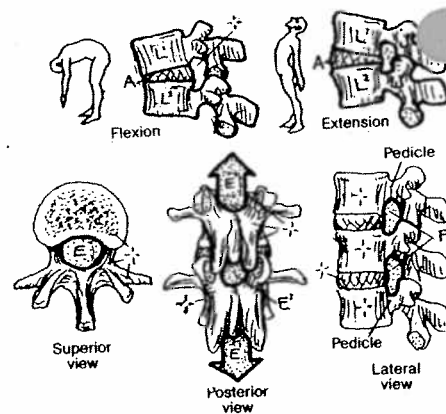
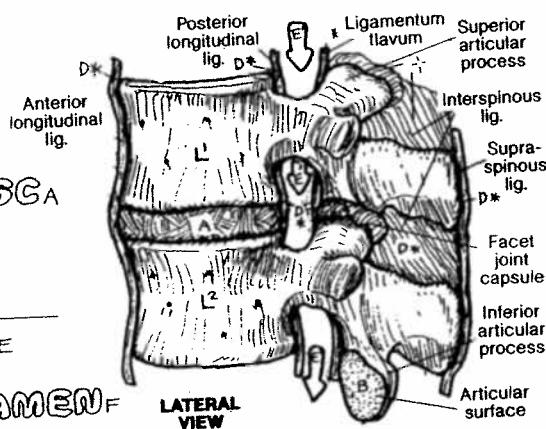
The vertebral column has 24 individual vertebrae arranged in *cervical*, *thoracic*, and *lumbar* regions; the *sacral* and *coccygeal* vertebrae are fused (sacrum/coccyx). Numbers of vertebrae in each region are remarkably constant; rarely S1 may be free or L5 may be fused to the sacrum (transitional vertebrae). The seven mobile cervical vertebrae support the neck and the 3-4 kg (6-8 lb) head. The cervical spine is normally curved (*cervical lordosis*) secondary to the development of postural reflexes about three months after birth. The 12 thoracic vertebrae support the thorax, head, and neck. They articulate with 12 ribs bilaterally. The thoracic spine is congenitally curved (*kyphosis*) as shown. The five lumbar vertebrae support the upper body,

torso, and low back. The column of these vertebrae is curved (*lumbar lordosis*) due to the onset of walking at 1-2 years of age. The sacrum is the keystone of a weightbearing arch involving the hip bones. The sacral/coccygeal curve is congenital. The variably numbered 1-5 coccygeal vertebrae are usually fused, although the first vertebra may be movable.

Vertebral curvatures may be affected (usually exaggerated) by posture, activity, obesity, pregnancy, trauma, and/or disease; these conditions are named the same as the normal curves. There may normally be a slight lateral curvature to the spine often due to dominant handedness; a significant, possibly disabling, lateral curve (*scoliosis*) may occur for many reasons.

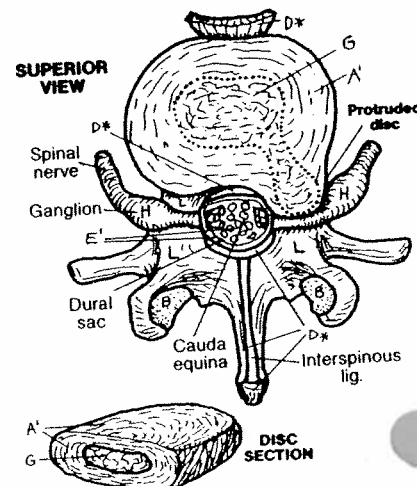
MOTION SEGMENT:*
VERTEBRA^L
JOINTS:*
INTERVERTEBRAL DISC^A
POSTERIOR (FACET)^B
LIGAMENT^{D*}
VERTEBRA^{L2}
VERTEBRAL FORAMEN^E
VERTEBRAL CANAL^{E'}
INTERVERTEBRAL FORAMEN^F

Each pair of individual, unfused vertebrae constitutes a *motion segment*, the basic movable unit of the back. Combined movements of motion segments underlie movement of the neck, middle and low back. Each pair of vertebrae in a motion segment, except C1-C2, is attached by three joints: a partly movable, *intervertebral disc* anteriorly, and a pair of gliding synovial *facet (zygapophyseal) joints* posteriorly. *Ligaments* secure the bones together and encapsulate the facet joints (joint capsules). The *vertebral* or *neural canal*, a series of *vertebral foramina*, transmits the spinal cord and related coverings, vessels, and nerve roots. Located bilaterally between each pair of vertebral pedicles are passageways, each called an *intervertebral foramen*, transmitting spinal nerves, their coverings/vessels, and some vessels to the spinal cord.

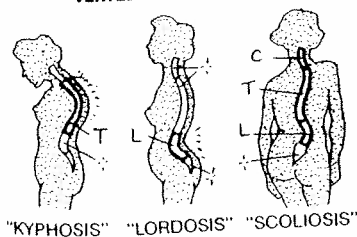


INTERVERTEBRAL DISC^A
ANNULUS FIBROSUS^{A'}
NUCLEUS PULPOSUS^G
SPINAL NERVE^H

The intervertebral disc consists of the *annulus fibrosus* (concentric, interwoven collagenous fibers integrated with cartilage cells) attached to the vertebral bodies above and below, and the more central *nucleus pulposus* (a mass of degenerated collagen, proteoglycans, and water). The discs make possible movement between vertebral bodies. With aging, the discs dehydrate and thin, resulting in a loss of height. The cervical and lumbar discs, particularly, are subject to early degeneration from one or more of a number of causes. Weakening and/or tearing of the annulus can result in a broad-based bulge or a localized (focal) protrusion of the nucleus and adjacent annulus; such an event can compress a spinal nerve root as shown.



VERTEBRAL DISORDERS



CN: Use gray for D, yellow for H, and light colors for the rest, especially C, T, L, S, and Co. (1) Begin with regions of the column and the three examples of vertebral disorders at lower left. (2) Color the motion segment and its role in flexion and extension. (3) Color the vertebral foramina and canal. (4) Color the example of a protruding intervertebral disc pressing on a spinal nerve.